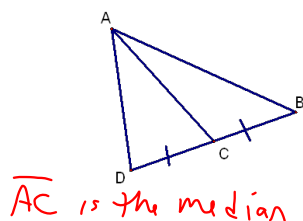
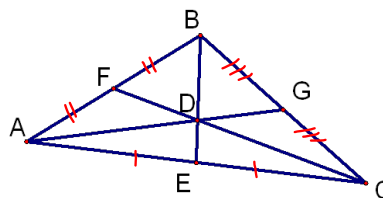


## 5.4 Use Medians and Altitudes

**Median**—is a segment whose endpoints are the vertex of a triangle and the midpoint of the side opposite the vertex.



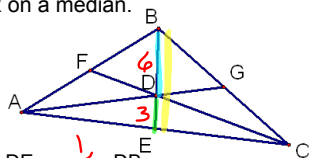
**Centroid**—The point of concurrency of the three medians of a triangle.



Thm 5.8 The Centroid Theorem—The centroid of a triangle is located two-thirds of the distance from a vertex to the midpoint of the side opposite the vertex on a median.

Conclusion:

*BE = 9*



$$DB = \frac{2}{3} BE \quad DE = \frac{1}{3} BE \quad DE = \frac{1}{2} DB$$

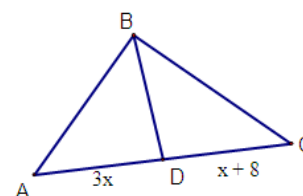
$$DA = \frac{2}{3} AG \quad DG = \frac{1}{3} AG \quad DG = \frac{1}{2} AD$$

$$CD = \frac{2}{3} CF \quad FD = \frac{1}{3} CF \quad FD = \frac{1}{2} CD$$

Examples:

1.  $\overline{BD}$  is a median in  $\triangle ABC$ . Solve for  $x$ .

$$\begin{aligned} 3x &= x + 8 \\ 2x &= 8 \\ x &= 4 \end{aligned}$$



2. G is the centroid.

$$AG = 7.4$$

$$AD = 6a$$

$$a = \underline{1.85}$$

$$GE = 5c$$

$$EB = 22.8$$

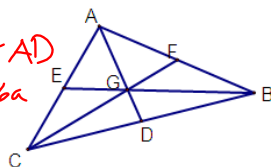
$$c = \underline{1.52}$$

$$AG = \frac{2}{3} AD$$

$$7.4 = \frac{2}{3} 6a$$

$$GE = \frac{1}{3} EB$$

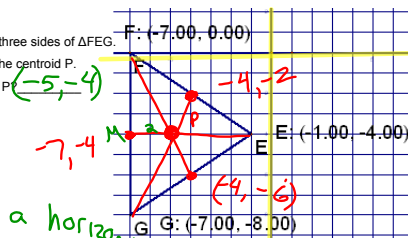
$$5c = \frac{1}{3} 22.8$$



3. Find the midpoints of the three sides of  $\triangle FEG$ .

Sketch the medians. Label the centroid P.

What are the coordinates for P?



Look for a horizontal  
or vertical median

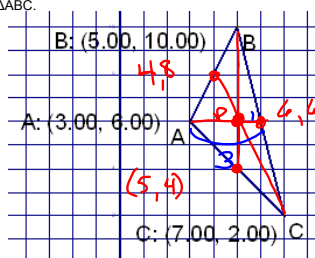
$$EM = 6$$

$$\frac{1}{3} 6 = 2 = MP \quad -7 + 2 = -5$$

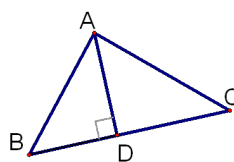
4. Find the midpoints of the three sides of  $\triangle ABC$ .

Sketch the medians. Label the centroid P.

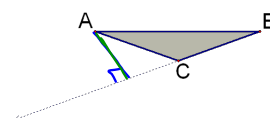
What are the coordinates for P? 5, 6



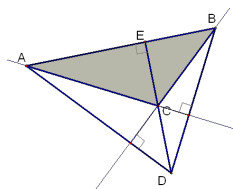
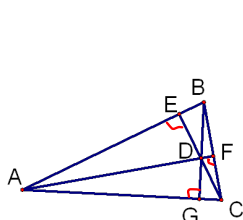
**Altitude**—of a triangle is a perpendicular segment from a vertex to the line containing the opposite side.



The altitude from A to  $\overline{BC}$  is on the outside of this triangle.



**Orthocenter**—is the point of concurrency of the three altitudes of a triangle.

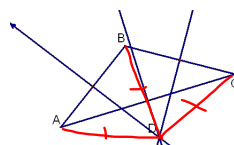


### Summary

The circumcenter. (3  $\perp$  bis.)

$$\overline{AD} \cong \overline{BD} \cong \overline{CD}$$

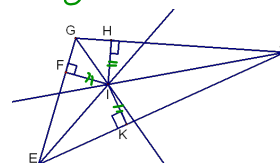
equid. to vertices



The incenter. (3  $\angle$  Bis.)

$$\overline{IF} \cong \overline{IK} \cong \overline{IH}$$

equid. to sides

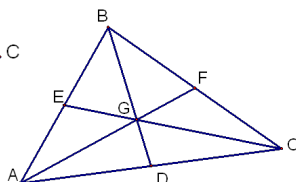
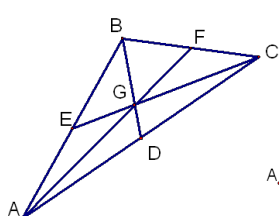


### The Centroid (3 medians)

$$\overline{BG} = \frac{2}{3} \overline{BD} \quad \overline{AG} = \frac{2}{3} \overline{AF} \quad \overline{CG} = \frac{2}{3} \overline{EC}$$

$$\overline{GD} = \frac{1}{3} \overline{BD} \quad \overline{GF} = \frac{1}{3} \overline{AF} \quad \overline{GE} = \frac{1}{3} \overline{EC}$$

$$\overline{GD} = \frac{1}{2} \overline{BG} \quad \overline{GF} = \frac{1}{2} \overline{AG} \quad \overline{GE} = \frac{1}{2} \overline{GC}$$



Challenge: Find the coordinates of the centroid of triangle ABC  
A(5, 4) B(1, -2) C(-4, 0)

Solve a system  
of equations

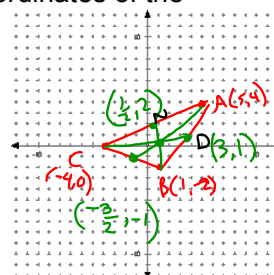
$$\overline{CD} \quad (-4, 0) \quad m = \frac{1}{7}$$

$$(3, 1) \quad y = \frac{1}{7}x + \frac{4}{7}$$

$$\overline{BN}$$

$$y = -8x + 6$$

$$\left(\frac{2}{3}, \frac{2}{3}\right)$$



HW  
p322-323  
#s 17-22, 25-27, 33, 35